third satellite observed at the Johannesburg Observatory on April 3.

Before and after the transit both the north polar cap and the dark marking along the north torrid zone of the satellite were noticed. When the satellite was about three-quarters of its journey across the planet a double dark spot was seen in its position, and re-focussing failed to alter the apparition. Approaching the limb of the planet the n.p. part of the double spot was replaced by a bright spot, smaller than the satellite, but s.p. the remaining grey mark. A few minutes before internal contact took place the dark grey spot disappeared, whilst the bright spot increased in size.

Immediately after last contact J III. was seen against the sky nearly round, but perhaps shaded off a little towards Jupiter, and with a small north polar bright spot with a darkish band below it. When the dark double spot was visible it looked like a close double star, dark instead of bright, having a separation of 0·9″ and an angle estimated at 300°.

The Spectrum of Magnesium in Hydrogen.—The significance of the "magnesium hydride" bands in the spectrum of sun-spots lends great importance to any investigation of their nature, and a paper, by Mr. E. E. Brooks, which appears in the April number of the *Astrophysical Journal* (vol. xxix., No. 3, p. 177), is therefore of astronomical interest.

Experimenting at the Leicester Technical School with magnesium in hydrogen, Mr. Brooks employed a unidirectional, but pulsating, current, which is intermediate between arc and spark, and arrived at the following conclusions regarding its spectrum:—(1) The spectrum represents some transitional unstable state; (2) although hydrogen is essential, the production of the "hydride" spectrum appears to depend far more upon the nature of the discharge than upon the quantity of the gas present; (3) a trace of water vapour appears to be more effective than hydrogen, yet its presence cannot be regarded as essential; (4) if due to a hydride the substance is probably decomposed as fast as it is formed.

The Perturbations of Brooks's Comet (1889 V) by Jupiter in 1886.—From his investigations of the perturbations, and the resulting path, of Brooks's comet, Prof. Poor concluded that this object could not be identified with the lost comet of Lexell.

In this regard an interesting paper, by Herr G. Deutschland, appears in No. 4321 of the *Astronomische Nachrichten*, giving the results of a re-investigation of the planetary perturbations, taking into account the oblateness of Jupiter. These results exhibit variations from those previously obtained by Prof. Poor, especially in the time of the comet's nearest approach to the planet.

Recent Observation of Daniel's Comet, 1907 *d*.—Among the photographic observations recorded by Prof. Wolf in No. 4321 of the *Astronomische Nachrichten* is one of an object which is, possibly, Daniel's comet of 1907. Owing to the faintness of the object and the poor sky, the identification is not quite certain, although the image appears on two plates. The middle of the exposure was at 13h. 25·4m. (Königstuhl M.T.) on April 19, and the position of the object was $\alpha = 15$h. 18·7m., $\delta = -7° 37'$; magnitude 16·5.

The Variable Star 6.1909 Ursæ Majoris.—In a note appearing in No. 4324 of the *Astronomische Nachrichten*, Prof. Wolf announces that the variable star near the spiral nebula M101 had decreased in brightness more than half a magnitude by May 9.

POLAR MAGNETIC STORMS.[1]

THE last ten or twenty years have been marked by great activity in Arctic and Antarctic expeditions. The results obtained in the department of terrestrial magnetism form a great contribution to knowledge, and prove that continued effort in this direction will do much to remove the difficulties that enshroud the problem.

The present expedition was the development of preliminary expeditions carried out in the preceding six years by Dr. Birkeland, the object being the study of the connection between and origin of auroræ and magnetic storms. The funds were provided by the Norwegian Government, by learned societies in Norway, and by Dr. Birkeland himself.

The preliminary expeditions had indicated the frequent occurrence of magnetic storms having a probable origin vertically above the vicinity of the North Cape, and the plan of the 1902–3 expedition was to make simultaneous observations at four stations in that region. The four stations were on Iceland, Spitsbergen, Nova Zembla, and in Finmark. Each of the stations was provided with a similar set of recording magnetographs of the pattern due to Eschenhagen. These are admirably suited for expeditions on account of their portability and simplicity of adjustment. They can be given a high sensibility, although some may doubt whether the high value used by Dr. Birkeland was altogether a blessing for the purpose of studying magnetic storms. It was, of course, a distinct advantage in studying the minute and extremely regular periodic movements that were frequently observed. In addition, each station was provided with auxiliary meteorological and electrical apparatus, and one of the stations had an instrument for recording earth currents.

The present volume begins with a description of the equipment and installation of the various stations, and those of us who live in temperate regions may well reflect on the advantage of making physical observations without having to interrupt work for the purpose of suppressing the scientific ardour of a polar bear.

In analysing the magnetic storms, Dr. Birkeland was able to obtain simultaneous records from twenty-three observatories in various parts of the world, in addition to those from the four special stations. Dr. Birkeland at the outset indicates that the results have been analysed and presented with the view of supporting the theory he holds, viz. that these storms are due to the incidence of (negatively) charged corpuscles projected from the sun. The desirability of such a method of procedure may be open to question but we think that the author has gained immensely by so doing, and the results are put in such a form that their value is not in the least prejudiced by whether we accept his ultimate conclusions or not.

The method is in outline as follows. Any disturbance of the magnetic needle may be represented as the effect of a certain electric current. The course of a storm may thus, so far as the horizontal components are concerned, be represented by an arrow of certain length in a certain direction. For each particular storm discussed the records from the various observatories are shown in a plate reduced to a uniform time scale. In the text a general description of the storm is given, followed by charts showing with arrows the direction and magnitude of the assumed disturbing current at different stages and at different places. These are followed by a discussion as to the general character of the horizontal current required to produce the storm.

The current charts are remarkably simple, and give an extremely clear presentation of the results free from any theory. In this way the existence of certain well-defined types of storm is established.

The supposition that these arrows represent true electric currents of corpuscles is almost a natural consequence. Arguments are given to show that they cannot be earth currents, but that they are probably due to streams in the upper regions of the air, the general height being some 400 kilometres.

It is remarkable that the stream so frequently sets between the four stations, and thus confirmatory evidence is obtained from the different signs of the vertical-force variations on opposite sides of the stream.

It is found that the horizontal stream is not always sufficient to account for the facts, but that the horizontal portion must be regarded as a bend in a stream descending vertically, and then with greater or less rapidity returned into space.

Dr. Birkeland supports, and we think very ably, his arguments by reference to experiments on a highly magnetised sphere (a terrella) placed in the path of kathode

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[1] The Norwegian Aurora Polaris Expedition, 1902–3. Vol. i., "On the Cause of Magnetic Storms and the Origin of Terrestrial Magnetism." By Kr. Birkeland. Pp. viii+315; 21 plates. (Christiania: H. Aschebourg and Co.; London: Longmans, Green and Co., n.d.) Price 22*s*. net.

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rays, the arrangements being made to imitate the earth with the sun as kathode. The experiments, of which numerous photographs are given, are exceedingly beautiful, and present distinct analogies with the deductions from the magnetic storms. At the same time, the analogies are by no means conclusive, and may in some cases be very misleading.

The work of analysing each storm independently must have been tremendous, but the results amply justify the work.

It is impossible to enter into details in such a brief review, but we think no serious student of terrestrial magnetism will read this book without feeling that a very distinct step has been made towards the solution of the refractory problem of terrestrial magnetism.

G. W. W.

ROCK-ENGRAVINGS IN SOUTH AFRICA.

MR. L. PÉRINGUEY, in the eighteenth volume of the Transactions of the South African Philosophical Society, continues his report on rock-engravings of animals and the human figure. The examples now described are superior in finish and artistic merit to those hitherto known. We have no longer mere lines or outlines produced by rough pointing or punching; the technique is more elaborate, and the figures are drawn in relief. Thus, in the illustration (Fig. 1) of an elephant fleeing before a hunter armed with a bow and arrow, the lines in relief represent the skin corrugation; and the position of the ears, the hanging lower lip, the curves of the back and legs, are all strikingly artistic, and suggest keen observation on the part of the sculptor. Equally artistic is the representation of the buffalo (Fig. 2), the figure of which is fully hollowed out, the attitude of the animal and the twitching of its tail being full of life.

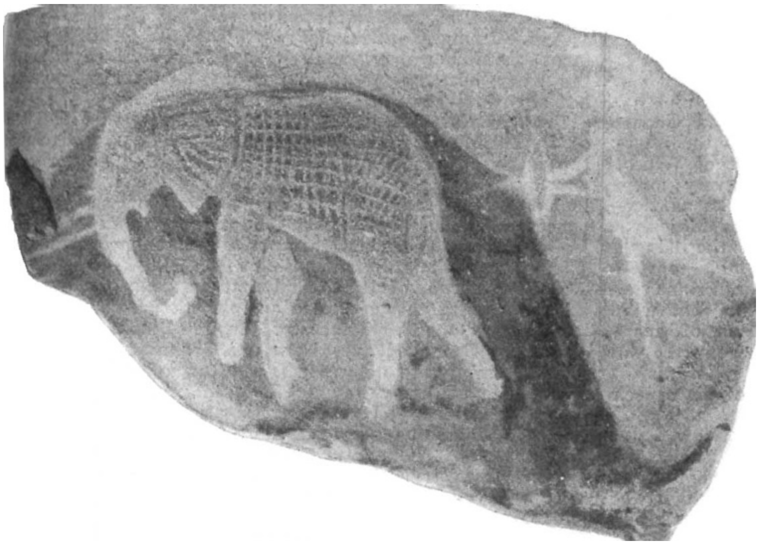

FIG. 1.—Rock-engraving of an elephant and hunter armed with bow and arrow. Size 60×39 cm.

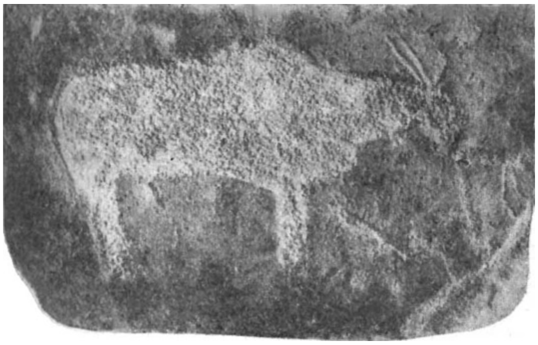

FIG. 2.—Rock-engraving of a buffalo. Size 60×40 cm.

The age of these sculptures is still uncertain. Mr. Péringuey, comparing them with similar rock-engravings in Algeria and the Sudan, and remarking the patination of the rock surfaces, the presence of Palæolithic implements in the neighbourhood, and the absence of scenes representing domesticated animals, believes them to be anterior to the Hottentot immigration. As in Mauretania, the most highly finished sculptures, as well as paintings, are the most ancient, and a decadence of artistic skill seems to have set in with the arrival of the newer immigrants. There is no evidence that these engravings were the work of the Bushmen, and it is equally difficult to attribute them to the Strand Looper Hottentots, whom Dr. Shrubsall has recently identified on the southern seaboard. On the whole, they suggest intercourse between North and South Africa, a view corroborated by the analogies between the engravings in Mauretania and those of South Africa, the identity of type in the stone implements in both these regions, and other considerations generally accepted by modern ethnologists.

CENTENARY OF THE PHYSICO-MEDICAL SOCIETY OF ERLANGEN.[1]

THE Physico-medical Society of Erlangen, founded by Joh. Christian Friedrich Harles in 1808, reached its one hundredth birthday on March 20, 1908, and celebrated the occasion on June 27 by an anniversary meeting and a dinner. The first of the two publications cited below contains (*a*) a history of the society, by Prof. M. Noelther, of the University of Erlangen, covering eighty-three pages, and illustrated by portraits of Harles, Henke, Leupoldt, Korn, Wagner, Canstatt, Gerlach, Gorup, Zenker, and Beetz; (*b*) an address, by J. Rosenthal, "Ueber die Beziehungen der Physik und Chemie zu den medizinischen Wissenschaften"; and (*c*) a report of the anniversary celebrations, by Oskar Schulz.

Honorary doctorships in medicine were conferred on Prof. Becquerel, Prof. Curtius, and Prof. Nernst; doctorships in philosophy were conferred on Sir Victor Horsley, Prof. von Leube, and Prof. von Kries. Honorary membership of the society was conferred, on general grounds, on Queen Margherita, Count Zeppelin, and Dr. Oskar von Miller; of the special sciences, chemistry was honoured by including in the list the names of Bechmann and Buchner; physics was represented by Blaserna, zoology by Dohrn, mineralogy by Zirkel, botany by de Vries, mathematics by Poincaré, geography by Günther, physiology by Pflüger, anatomy by Roux, and the medical sciences by Erb, Ehrlich, Kocher, and Kraepelin. Amongst the new corresponding members we notice the names of Prof. Rutherford, of Manchester, and Prof. Sherrington, of Liverpool.

The *Sitzungsberichte* for 1907, sent out with the report of the centenary, is a bulky volume containing seventeen scientific communications. Nearly half the volume is devoted to a memorial notice of Henri Moissan, written by Gutbier, and extending over 260 pages; a complete list of Moissan's papers is given, and his work on fluorine, boron, silicon, ammonium, calcium, diamond, the

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[1] (1) Festschrift der Physikalisch-medizinischen Societät zu Erlangen, zur Feier ihres 100 jährigen Bestehens am 27 Juni, 1908. Pp. ix+124. (Erlangen: Kommissionsverlag von Max Mencke, 1908.)

(2) Sitzungsberichte der Physikalisch-medizinischen Societät in Erlangen. Redigiert von Oskar Schulz, 39 Band, 1907. Pp. xxiv+562. (Erlangen: Kommissionsverlag von Max Menche, 1908.)

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